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[SECOND SERIES.]

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“..... per litora spargite muscum,  
Naiades, et circùm vitreos considite fontes :  
Pollice virgineo teneros hic carpite flores :  
Floribus et pictum, divæ, replete canistrum.  
At vos, o Nymphæ Craterides, ite sub undas ;  
Ite, recurvato variata corallia trunco  
Vellite muscosis e rupibus, et mihi conchas  
Ferte, Deæ pelagi, et pingui conchyliis succo.”

*N. Parthenii Giannettasii* Ecl. 1.

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I.—*Contributions to the Knowledge of the Terrestrial Planariæ, from communications from Dr. Fritz Müller of Brazil and personal investigations.* By Dr. MAX SCHULTZE\*.

THE travels of the English naturalist, Charles Darwin †, have made us acquainted with a rich fauna of terrestrial *Planariæ* in the humid regions of primæval forest in South America, which merits the attention of zoologists in a high degree. If it was impossible to help being astonished, in the first place, at the remarkable circumstance that worms belonging to the order of the *Turbellaria*—which we are accustomed to find only in water in Europe, and which, in consequence of their extremely soft, delicate parenchyma, destitute of all supports, appear destined to live exclusively in that medium,—should occur on land, our interest would be no less attracted by the statements of the large size of these animals, the variegated colours with which they were adorned, and their Nemertoid form combined with the internal structure of the *Planariæ* of our fresh waters. The

\* Translated by W. S. Dallas, F.L.S., from a copy of the paper in the ‘*Abhandlungen der Naturforschenden Gesellschaft in Halle*,’ vol. iv. 1857, kindly communicated by the author.

† *Naturwissenschaftliche Reisen*, deutsch von E. Dieffenbach, 1844, p. 28; *Annals and Magazine of Natural History*, first series, vol. xiv. p. 241, 1844.

demand for new and more detailed information upon the natural history of these inhabitants of the primæval forests has unfortunately been very sparingly satisfied since the date of the statements of the meritorious traveller. It therefore gave me peculiar pleasure to obtain such information from an approved observer, Dr. Fritz Müller, who has been settled for some years in the colony of Blumenau in the south of Brazil, and now in Desterro, on the island of Santa Catharina. Although his statements have been thrown off under unfavourable external circumstances, and without those optical aids which would have been desirable, I do not hesitate to publish them, as forming valuable additions to our previous knowledge. I at the same time take the opportunity to bring together what we know of these animals from Darwin and some others, and, lastly, add the results of some microscopic investigations into the intimate structure of these animals, which I made upon a specimen, well preserved in spirits, brought home by Dr. Burmeister, and handed over to me to be used as I pleased.

It is well known that O. F. Müller, the founder of our knowledge of the Turbellaria, discovered a species living upon the land, under stones in moist earth, to which he gave the name of *Planaria terrestris* (Vermium Terr. et Fluv. Hist. ii. p. 68). According to the short description of this animal given by the celebrated Danish zoologist, it possesses a nearly cylindrical body, only somewhat flattened on the ventral surface, 8 lines in length, and  $\frac{2}{3}$  rds of a line in breadth; it is blackish-grey above and white beneath, and exhibits two small black eye-spots at the anterior extremity. Dugès saw the same species in France (Ann. des Sci. Nat. 1 sér. xxi. p. 82); and adds to Müller's statements, that the position of the buccal orifice, the form of the muscular œsophagus, the arborescent ramifications of the intestinal canal, the male copulative organ, and the seminal vessels, agree with the same parts in our freshwater species.

As far as I am aware, my friend Fritz Müller is the only person who has since this period met with the animal, which is certainly a rarity. It was in the neighbourhood of Grimmen, near Greifswald, that several specimens were discovered under stones; they were unfortunately only examined with the lens, but exhibited all the parts described by Dugès.

In the following, I have brought together F. Müller's statements regarding the *Terrestrial Planariæ of Brazil*, which have reached me in various letters:—

“Points of agreement with the *Planariæ* of fresh water are, the position of the buccal orifice towards the hinder third of the lower surface of the body, and also the dendrocœlar nature of the intestine; in the latter, there are the ordinary three branches,

an anterior and two posterior, the ramifications of which are usually repeatedly divided. The proboscis, as it glimmers through the skin, appears as a long cylinder, in the middle of which the buccal orifice is visible as a transverse cleft. On a closer examination of the proboscis after removal, however, it is found that it may be dilated into a considerable flat cup or disk, which is sometimes elliptic, sometimes roundish, with its circumference sometimes nearly entire, sometimes more or less deeply lobed, and exhibits in its base, a little before the middle, a rather narrow œsophageal orifice, a structure which occurs in many of the larger marine *Planariæ*, but not in our freshwater species. In repose, the lateral margins are rolled in, and the whole organ folded together in such a way that it represents a cylinder with an anterior, undulated, longitudinal fissure.

“Points of difference from the genus *Planaria* are, the elongated form of the body, the slight depression, and the acute anterior extremity. The habit is thus often more that of a *Nemertoid* than of a *Planaria*. The eyes also, as far as they are known, are different; they are present in unusual number, not, as in *Planaria nigra*, forming a simple series, running regularly on the anterior margin, but compressed into dense streaks or spots near the anterior margin, and extending from thence in an irregular row, which constantly becomes less dense posteriorly along the lateral margins to the hinder extremity.

“These peculiarities, in conjunction with their dwelling-place, certainly justify their generic separation from the aquatic *Planariæ*. In accordance with the analogy of *Typhloplana* and *Leptoplana*, the name *Geoplana* might be formed for them. They like moderately moist places, under wood, bark, and stones, and between leaves of the Bromeliacæ (but not in the water there accumulated). They appear to rest by day, and to crawl about during the night. Eggs somewhat larger than those of *Planaria Ulvæ*, and roundish, which could hardly belong to any other animal, were once found under wood.

“An important question is, whether the *Geoplana*, like their aquatic allies, bear cilia upon the surface of their bodies. Not possessing a microscope, and remembering an experiment in J. Müller’s physiological course, I sprinkled a large specimen of *Geoplana rufiventris* with a little arrowroot, when I saw it move constantly forwards and sometimes a little outwards on the back, and backwards on the ventral surface, by which the existence of cilia seems to be placed beyond a doubt.

“The species hitherto observed are:—

“1. *Geoplana tristriata*, pale yellowish-green, with three narrow, dark, longitudinal lines on the back; belly paler. Greatest breadth about the second third part of the length, where the

mouth is situated. It likes to bend the head upwards. At the point of curvature on each side there is a closely packed group of eye-spots, which are continued in an irregular series to the posterior extremity. The anterior margin of the head appears to be destitute of eyes. Length  $1\frac{1}{2}$  inch; breadth  $1\frac{1}{2}$  line. Abundant.

“2. *Geoplana octostriata*. Habit and eyes as in the preceding species; colour pale yellow; belly whitish; on each side of the back four dark brown, approximated, longitudinal streaks, far broader than the longitudinal lines of the preceding. Not rare.

“3. *Geoplana elegans*. Habit similar, but a little less attenuated in front. Length  $2\frac{1}{2}$  in., with a breadth of 1 line. Eye-spots very small, forming a rather broad dense band anteriorly, becoming narrower and less dense posteriorly, and passing into a simple row. Colour yellow; belly paler; on the middle of the back a broad, deep black, longitudinal stripe, and between this and the lateral margin on each side a narrow, deep orange-coloured longitudinal stripe. Only found once.

“4. *Geoplana pallida*. Of a similar form to the preceding. Colour yellowish-white, with a single narrow, blackish, longitudinal stripe on the back. Several specimens between boards.

“5. *Geoplana atra*. Deep black, beneath grey; nearly cylindrical, but little attenuated before and behind. The eyes difficult of detection, although present. Proboscis more cylindrical than in the freshwater *Planariæ*, but always much wider at the buccal than at the œsophageal extremity. Length 9 lines; breadth  $\frac{1}{2}$  a line. Found once under the bark of a rotten Figueira (*Ficus doliaria*?).

“6. *Geoplana marginata*. Back and belly deep blackish-brown, shining, with narrow, golden-yellow, longitudinal bands on the middle of the back, and broader dull yellow bands along the lateral margins; in the latter the eye-spots are very distinctly visible, closely approximated in front, posteriorly in a simple loose series. The animal, which was 3–4 inches in length, and some lines broad, much attenuated before and behind, was creeping in the house.

“7. *Geoplana rufiventris*. Back dark brown; belly tile-red; moderately attenuated before and behind. The eyes closely grouped in several rows, distinct on the margins of the anterior part of the body, not detected posteriorly. The animal, which was a few lines in breadth, and several inches long, was found on wood.

“8. *Geoplana olivacea*. Belly yellowish-grey; back greenish-brown with dark brown longitudinal bands margined with paler colour, darker towards the margins, paler towards the head.

Eyes along the entire margin of the body, closer in front, very much scattered behind. Not rare.

“9. *Geoplana Nephelis*. Resembling the preceding in form, but somewhat less elongated; in form and colour it reminds one of a *Nephelis*. Back uniform brown; belly paler. Not rare.

“10. *Geoplana Maximiliani*. Almost like the preceding; the back with a paler, yellowish, longitudinal band. This species, however, is further distinguished from the preceding one by its mouth and genital orifice being placed far more posteriorly, and its penis being almost globular, whilst in *G. Nephelis* this organ is long and cylindrical. In the latter, also, the orifice of the proboscis appeared to have entire margins, whilst in *G. Maximiliani* (when examined in a spirit specimen) it appeared deeply five-lobed.

“11. *Geoplana marmorata*. Length 4 inches, breadth 4 lines. The eye-spots present nothing remarkable. The dorsal surface is pale reddish-grey, with small black spots arranged in irregular, repeatedly-anastomosing, longitudinal rows; the ventral surface is pale grey. The proboscis is dilatible into a flat cup with an undulated margin (in a spirit specimen).

“12. *Geoplana pulchella*. The anterior third of the body above brownish tile-red, with oval whitish spots; beneath grey, with a whitish band in the middle. Eye-spots considerably approximated near the anterior margin; their series uninterrupted on the anterior margin, missing on the posterior two-thirds of the body. About an inch long, by fully 1 line in breadth, not very much attenuated anteriorly. Only once observed.

“13. *Geoplana subterranea*. This, even from its abode, is peculiarly interesting, as it again enlarges the circle of vital conditions under which this animal form is enabled to exist. After finding Flat-worms in the clear spring-water of the mountains, as well as in the lakes and fens of the plains, under the stones of the sea-coast, as on the floating sea-weeds in the midst of the ocean; after obtaining the prospect of a rich fauna of terrestrial *Planariæ* which conceal themselves in damp moss, under stones and bark, and rise to the summits of the primæval forest, where, between the spinous leaves of the *Bromeliæ*, they find a perpetually humid asylum,—*Earth-Planariæ* now make their appearance, companions of the Earth-worms and grubs. In characteristic opposition to its coloured congeners, so abundantly supplied with eyes, which live above the surface of the earth, this *Geoplana*, dwelling in darkness, is without both the adornment and the sense of colour,—milk-white and destitute of eyes. In its habit, this species is more removed than any other from the typical form of *Planaria*. Its uniformly narrow, very long body, rounded off at the extremities, which, with a length of

2-3 or even more than 4 inches, scarcely attains a thickness of  $\frac{3}{4}$ ths of a line, gives it exactly the appearance of a *Nemertina*. When the intestine is full, its contents, shining through the skin, give the milk-white colour a more or less vivid tinge of flesh-colour or rosy-red. The buccal orifice is removed unusually far backwards; the genital orifice is situated quite in the vicinity of the posterior extremity; the proboscis is bell-shaped; the intestine of the ordinary form, with its lateral branches simple or forked, placed close together.

"The animal lives especially in loose and sandy, but also in heavy and tenacious clay soils, in company with *Lumbricus corethrurus*\*. It may seem strange that so soft an animal, which scarcely bears to be gently touched, should be able to exist and make its way through this medium. This difficulty is got over by the Earth-worms, which burrow through the soil in such a way, that it is penetrated in all directions, like a sponge, by smooth passages of various widths. As a reward for this, the Earth-worms are devoured, or rather sucked, by the Flat-worm. That this was the mode of nourishment, was easy to see, from the colour of the contents of the intestine. But I have also met with *Geoplanæ* which were holding a young *Lumbricus* with their protruded proboscis, and whose intestines were beginning to be filled with fresh blood.

"For the microscopic investigation of the internal structure, this species would be better adapted than any other, not only on account of its transparency, but also because, with a little patience, it may be dug out of the ground in any quantity. All the other *Geoplanæ* occur but rarely, as is certainly the case with the European *Planaria terrestris* of O. F. Müller."

So far the communications of my friend Fritz Müller.

I may be allowed to add to these specific descriptions, those which have been made known by others, which occur scattered in various Journals, and have never yet been brought together. As regards the generic name *Geoplana*, this appears to be so well chosen, that zoologists will certainly acquiesce in it. The necessity of the generic separation of the terrestrial *Planariæ* from the others was felt even by Darwin, who says: "The terrestrial *Planariæ* belong to the genus *Planaria*, Dugès, *Polycelis*, Ehrbg.; they may, however, form a distinct section of this genus, characterized by their more roundish narrow body, and the usual presence of longitudinal stripes of very brilliant colours." Nevertheless Darwin established no new name for them. Besides the English traveller, Blanchard and Leidy have described terres-

\* The description of this new species of Earth-worm will follow this paper.

trial *Planaria*. The former\* received specimens preserved in spirits of a species observed in Chili by Claude Gay; these he made use of for anatomical investigations which will be hereafter referred to. Blanchard named the species *Polycladus Gayi*. The generic name cannot be extended to all terrestrial *Planariæ*, and remains attached provisionally only to this species. The same is the case with the name *Rhynchodemus*, given by Leidy† to a North American terrestrial *Planaria*.

Darwin's terrestrial *Planariæ* are as follow ‡:—

- |                                    |                               |
|------------------------------------|-------------------------------|
| 14. <i>Geoplana vaginuloides</i> . | 19. <i>Geoplana pallida</i> . |
| 15. <i>G. elegans</i> .            | 20. <i>G. elongata</i> .      |
| 16. <i>G. pulla</i> .              | 21. <i>G. semilineata</i> .   |
| 17. <i>G. bilinearis</i> .         | 22. <i>G. maculata</i> .      |
| 18. <i>G. nigrofusca</i> .         | 23. <i>G. Tasmaniana</i> .    |

Of these species described by Darwin, some, most probably, agree with those observed by F. Müller. Thus the *G. elegans* of the latter may sink in the *G. vaginuloides*, Darwin, and the *G. pulla*, Darwin, may be identical with *G. olivacea* or *Maximiliani*, Müller. A final decision could only be furnished by figures, which, however, are not given by Darwin, nor as yet by F. Müller. If the two first-mentioned species should prove to be distinct, Müller's *G. elegans* must receive another name, as this has already been given by Darwin to another species, referred to above under No. 15. In any case, however, Müller's name *pallida* must be changed, as Darwin's species of the same name has the right of priority. From its pure white colour the latter might remind us of the *G. subterranea*, if the strongly-marked absence of the eyes did not sufficiently show the right of the form living under ground to rank as a distinct species.

The two above-mentioned species, described by Blanchard and Leidy as coming in addition to the 23 already referred to, are:

24. *Geoplana (Polycladus) Gayi*, Blanchard. Blackish-green on the back, with a white median line; the margin with a broad orange border, which is bounded by two narrow black lines; ventral surface orange.

Length 85–90 millimetres; breadth about 30 millimetres.

*Hab.* Chili, in moist places on the ground.

\* *Historia de Chile* p. Claude Gay, Vers, pl. 1. fig. 2 (which I have been unable to consult); *Ann. des Sci. Nat.* 3 sér. viii. p. 140.

† Proceedings of the Academy of Natural Sciences of Philadelphia, vol. v. 1850–1851, pp. 241 & 289.

‡ [The author has translated all Darwin's descriptions, which, however, we have omitted, as they were originally published in this Journal, *loc. cit. supra*. He has substituted Dr. Müller's generic name, *Geoplana*, for that of *Planaria*, under which Mr. Darwin described his species.—ED.]

25. *Geoplana (Rhynchodemus) sylvatica*, Leidy. Body elongate, fusiform, attenuated in front, pointed behind; the ventral surface somewhat flattened. Colour on the back grey, with two brown stripes along the median line, and a transverse brown spot at or close behind the middle; belly whitish; head brown, bent upwards, exhibiting two black, lateral eyes. Length, 2-5 lines; breadth in the anterior fourth,  $\frac{1}{8}$ th line; in the posterior,  $\frac{1}{4}$ th line.

Lives between stones, flower-pots, &c., in the gardens of Philadelphia, and also under wood and fragments of bark in the woods of the neighbourhood.

As a twenty-sixth and last species this is followed by the *Geoplana (Planaria) terrestris*, O. F. Muller, the only species hitherto observed in Europe. This has been already referred to.

What Darwin and Leidy tell us with regard to the anatomy of the terrestrial *Planariæ*, refers solely to the parts recognizable with the naked eye, or with a low magnifying power, such as the alimentary apparatus, the efferent parts of the sexual apparatus, and the eyes; they are fully confirmed by the statements of F. Müller, communicated above. The form of the ramified intestine is the same in all as in our well-known fresh-water species; this is also the case with the position of the buccal orifice. Only the form of the œsophageal tube differs essentially, as F. Müller particularly points out, in several species, by the cylindrical form becoming converted more into a trumpet-shape, with repeatedly folded margins to the outer orifice. The genital orifice is situated throughout behind the mouth, and is always simple, by which the terrestrial *Planariæ* are removed from the large marine forms, for a knowledge of which we are especially indebted to Quatrefages\*, and some of which I have myself been able to examine †. The penis and seminal ducts have been detected in several species. Where eyes are present there are either *two*, as in *G. terrestris* and *sylvatica*, or *many*, and these are then always distributed on the margin of the animal in groups, at pretty uniform distances apart, or more singly. Darwin and Leidy state that they contain a refractive body.

The above statements regarding the position of the buccal and genital apertures do not agree with what Blanchard says of his genus *Polycladus*. In this the buccal orifice is said to be in the *anterior*, instead of the posterior third of the body, the genital orifice still farther forward. From the further description of the animal, however, it appears clearly that these

\* Ann. des Sci. Nat. 3 sér. iv. p. 129.

† Verhandl. der phys. med. Gesellsch. in Würzburg, iv. 1854, p. 222.



statements are founded merely upon a confusion between the anterior and posterior extremities, which may be excusable, as Blanchard did not see the animal living\*. With such a notion, however, Blanchard's statements upon the central nervous system in *Polycladus Gayi* of course lose all value. This is said to consist of two cerebral ganglia, situated over the seminal vesicle, and two cords running backwards (forwards) which are again interrupted by several (up to 14) small ganglia. What organ has been confounded here with the nervous system, it is hard to say; at any rate no cerebral ganglia can be situated above the seminal vesicle, but they must be sought at the opposite end of the body.

In this certainly imperfect state of our knowledge of the structure of the terrestrial *Planariæ*, I very opportunely obtained a specimen of such an animal. It was found by Dr. Burmeister, near Rio Janeiro, and put, whilst living, into spirits, in which it had been very well preserved, with the exception of an accidental injury in the middle of the body. The tissues, indeed, were only partially applicable to microscopic examination. Nevertheless, by the aid of glycerine, which is often exceedingly serviceable in the clearing up of spirit preparations for the microscope, I succeeded in obtaining an insight into the finer structure of several systems of organs. Unfortunately, the development of the generative organs was so backward in the animal, that nothing could be ascertained with regard to the sexual glands.

My specimen belongs to none of the 26 species above characterized, and I therefore introduce it into the system under the name of *Geoplana Burmeisteri*. Its length is  $2\frac{1}{2}$  inches; its greatest breadth behind the middle of the body  $\frac{1}{2}$  an inch; its thickness 1 line. The body is pointed before and behind; attenuated more rapidly posteriorly, and anteriorly very gradually and drawn out into a long point. The colour of the back is sepia-brown, blackish-brown at the anterior extremity; a pale brown streak runs along the middle of the back from the anterior to the posterior extremity, very distinctly and sharply bounded by nearly black margins in the anterior quarter of the animal, then obsolete, and only distinct again in the vicinity of the hinder extremity. On the back also a quan-

\* I may, however, mention in passing, that this is not the first error of the kind into which this observer has fallen. He has slipped into the same mistake with the *Caryophyllæus*, which is so common in the intestine of *Cyprinus Brama* (Ann. des Sci. Nat. 3 sér. x. p. 323, pl. 12. figs. 1, 2). Here also the extremity furnished with the organs of generation is marked as the *anterior*, whilst it is really the *posterior*, as was rightly perceived by all the older observers.

tity of small, circular, whitish points are scattered; these can just be perceived with the naked eye, are smaller and closer together in the anterior half, and finally disappear entirely at the head. The lower surface is uniformly greyish-yellow, and exhibits close behind the middle the buccal orifice, from which, in my specimen, the repeatedly folded, funnel-shaped buccal extremity of the œsophagus projects, and 5 lines further back, the very small genital orifice. Eyes were discovered by the microscopic examination of the margin of the anterior half of the body; they form blackish-brown pigment-spots, usually of a crescent-shape, lying pretty close behind one another in a single row, in the concavity of which, directed outwards, there is a round transparent body, which does not refract light very strongly, and in this respect exactly resembles the similarly placed body, which must be regarded as a lens, of the eye of our freshwater *Planaria*.

The microscopic examination of the skin in the first place confirmed the supposition expressed by F. Müller, that in this, as in the other Turbellaria, a ciliated epithelium exists, although, from his observation recorded above, this hardly required microscopic proof. Although the ciliary coat in general had suffered greatly by preservation in spirits, the epithelial cells with their crown of cilia could, nevertheless, be unmistakably recognized in particular places. Whether this coat of cilia be general, or, as in many Mollusca, only present on particular parts of the body, could not be decided. Nevertheless, from analogy with the other Turbellaria, we are scarcely justified in doubting that this coat is uniformly diffused. The ciliary cells are colourless, and usually of a wedge-shape. In many of them the thickening of the anterior cilium-bearing cell-membrane was unmistakeable, and this appears to occur as universally in these epithelial structures as in the cylindrical cells of the intestine, according to the observations of Funke and Kölliker. Below them there is a layer of irregularly hexagonal pigment-cells, which are the seat of the true principal colour. *Bacillar bodies*, which, as is well known, occur so universally in marine and freshwater *Planariæ*, were entirely wanting in the skin of my *Geoplana*. These, as I have repeatedly observed, may be very well preserved in spirits, so that their absence could hardly be due to the mode of preservation.

As in the other Turbellaria, a cutaneous muscular network follows beneath the cells of the skin, and in the first place, indeed, a simple layer of closely approximated longitudinal fibres. Below these is a closer layer of *transversely placed* muscular elements. The former readily separate in connexion with the cells of the epidermis, in the form of a thin membrane,

from the annular muscles, which on their part enter into an intimate union with the viscera, and especially with the finer terminal ramifications of the intestine, so that they cannot be removed without adherent portions of the latter. The condition of maceration of my *Geoplana*, caused by its preservation for several years in spirits, facilitated the separation of the above-mentioned layers, which could hardly have been effected in the fresh state.

The elements of these muscular layers are long fibres of 0·0006–0·002 line in breadth, homogeneous throughout, without any distinct envelope and contents, and without traces of transverse striæ, exactly resembling those which I have described and figured in the *Rhabdocœla* amongst the Turbellaria (Beitr. zur Naturgesch. der Turbellarien, 1850), and like those which occur in the larger aquatic *Dendrocœla*. Narrow and broad fibres are intermixed, the narrower ones greatly predominating in number; the broader fibres divide more frequently, and in certain cases penicillate radiations are seen upon them.

The space surrounded by the annular muscles was found to be entirely filled by the intestinal canal, whilst, as has already been stated, nothing could be detected, in my specimen, of the secreting portions of the generative organs, which in sexually mature animals will certainly push itself to a greater or less extent between the ramifications of the intestine. In the immediate vicinity of the genital orifice alone, the globular copulative organ occupied a comparatively considerable space. The commencement of the intestine was indicated by the externally projecting, folded, buccal orifice of the œsophagus, which was of a white colour, and formed of densely interlaced narrow muscular fibres. The œsophagus is continued forwards, concealed beneath the skin, and occupying nearly the whole thickness of the animal, in the form of a cylinder about 1 line in thickness, and 4 lines long. From it, at the extremity opposite to the buccal orifice, originate three branches of the intestine, one running forward in the direction of the œsophagus, gradually becoming attenuated, as it gives off numerous branches at right angles, and reaching nearly to the anterior extremity; and two passing backwards, which being bent upwards run along and above the œsophagus to the posterior extremity, and emit numerous branches outwards. These principal branches, and the larger secondary branches of the alimentary tube possess strongly muscular walls, and an internal epithelial coat of small cells. As the division of the lateral branches of the alimentary canal gradually becomes finer, the muscular layer grows proportionately thinner, whilst the epithelial cells become larger and

more darkly granular, until the racemose extremities of the intestinal ramifications, which are attached to the inside of the annular cutaneous muscles, are formed exclusively of the epithelial cells, only surrounded by a delicate structureless membrane. These largely cellular extremities of the ramified alimentary tube may be compared to a liver in their function.

The muscular fibres of the alimentary canal are for the most part similar to those of the skin above described. Besides these, however, there are other muscular elements in the entire extent of this system of canals, and these are not dissimilar in form to the organic fibre-cells of the higher animals. They are usually fusiform, flattened bodies, with rounded or irregularly torn ends, of a similar size and form with the broad, short fibre-cells of arterial membranes, which I have figured in my Inaugural Dissertation "De arteriarum notione, structura," &c., 1849, tab. 3, figs. 2 & 4. They are transparent, pale, colourless, and not granular, but, on the other hand, are provided with an indication of longitudinal striation; they are homogeneous or exhibit a granular central streak, which either runs through the whole length of the fibre-cell-like body, or is only perceptible for a short space in the centre. This streak always possesses a swelling in the middle and is pointed at the ends; it has, however, no similarity to a sharply defined nucleus, but rather resembles the granular axial cords of the muscular filaments of the Mollusca which C. Semper has recently described (Siebold and Kölliker's *Zeitschr.* viii. p. 345. tab. 7. fig. 10). The form of the bodies described varies in many ways. Although the spindle-shape is the most usual, a few clavate bodies occur, which are drawn out at one extremity into a long filament; others resemble fragments of fibres, and others again represent actual long fibres, but at the same time, in their refractive power and the indication of the longitudinal striation, perfectly resemble the fusiform bodies, although their breadth is less, so that a transition of the one form into the other cannot be mistaken. All these elements occur in the walls of the alimentary tube mixed with narrow muscular fibres, such as I have described as situated in the skin, and to these again they exhibit distinct transitions, so that, for this reason especially, I do not hesitate to draw a conclusion as to the muscular nature of the fusiform bodies. It appears, therefore, as though the broadest of the muscular bands in the body of my *Geoplana* were composed of single elements similar to the fibre-cells of the higher animals, which after maceration may be easily isolated, or readily break away where they were previously firmly united, whilst the narrower ones form long, continuous filaments in which a coalescence of several cells is no longer to be perceived, or has never existed.

Enclosed in the œsophagus of the animal I found a morsel of food, consisting of the grinding-plate and jaws of a snail with adherent muscular parts. This observation, like the statements of F. Müller as to the war of destruction waged by *Geoplana subterranea* against the Earth-worms, is opposed to Darwin's supposition that the terrestrial *Planariæ* only feed upon vegetable food, and indeed upon rotten wood, on which they are principally found. Darwin certainly kept some specimens in confinement for 21 days, without giving them any other nourishment than rotten wood, and during this period the animals grew considerably. Nevertheless this observation could not be decisive, as the contents of the intestine were not examined. The intestine of my specimen did not contain a single vegetable cell.

Of the nervous system nothing could be ascertained by preparation; and of the sexual organs I have only to mention the seminal vesicle, and the penis, which may be easily isolated at the genital orifice in the form of a globular body of  $\frac{1}{2}$  a line in diameter. The seminal vesicle contained no spermatozoids. The true form of these contractile organs, which are composed of very fine muscular fibres, can only be ascertained by the examination of fresh specimens. The same applies to the sexual glands, the water-vascular system, &c. But for the purpose of subsequent histological investigation, a solution of 1-2 grains of bichromate of potash in the ounce of water will always be far preferable to spirits for the preservation of these extremely delicate animals, and I warmly recommend this solution to all collectors.

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II.—*Description of a new species of Earth-worm (Lumbricus corethrurus). By Dr. F. MÜLLER\*.*

*Lumbricus corethrurus*, Brush-tail, the commonest of the Earth-worms of this country (Brazil), and which may be found in almost every clod of arable land, is rather slender, soft, and readily torn; the skin is nearly colourless, translucent, so that the colour of the body is principally caused by the intestine and blood-vessels, and therefore it appears more reddish towards the anterior extremity, grey in the middle, and pale reddish-white posteriorly. The measurement of nine animals all bearing clitelli (and killed in spirit of wine, because the length is constantly varying during life) gave on the average 28<sup>'''</sup> in length, of which the clitellus measured 3<sup>'''</sup>, and the space in front of it 4<sup>'''</sup>. The body is cylindrical, attenuated anteriorly from the clitellus, and of

\* This description is given by Schultze, and is referred to in the preceding paper, at p. 6.